WSDOT MITIGATION SITES
OLYMPIC REGION

2003 MONITORING REPORT

Wetland Assessment and Monitoring Program

Monitoring Staff
Jesse Barham
Jodie Beall
Fred Bergdolt
Tony Bush
Paul Dreisbach
Cyndie Prehmus
Tuesday Shean
Bob Thomas

Issued March 2004

Washington State Department of Transportation

Environmental Services Office

Olympic Region 2003 Annual Monitoring Report

For additional information about this report or the WSDOT Wetland Assessment and Monitoring Program, please contact:

Washington State Department of Transportation
Environmental Services Office
P. O. Box 47332
6639 Capital Boulevard South
Tumwater, WA 98504-7732

Fred Bergdolt, Wetland Monitoring Field Coordinator
Phone: 360-570-6645
E-mail: bergdof@wsdot.wa.gov

Table of Contents

Appendices

Executive Summary

The following tables summarize success standards and results obtained in 2003.

Clallam County Site

Site Name	Success Standards	2003 Results
SR 101 Sequim (Year 3/10)		
	Presence of wetland hydrology (2005)	Present
	Suitable breeding habitat for amphibians (2005)	Amphibians observed
	Install a minimum of 5 snags as perch trees, 5 large woody debris piles and 10 bat boxes (2001)	Present
	Provide a riparian corridor along Bell Creek which provides some shade along a minimum of 40% of the stream (2010)	North bank: 48% South bank: 62%
	Exclude cattle from the mitigation site	Cattle not observed

Pierce County Sites

Site Name	Success Standards	2003 Results
SR 7 Nisqually Slough (Year 2/5)		
	Hydrology present	Present
	$\leq$ 20% cover by invasive species in the wetland or buffer	Wetland: 4% ($CI_{80\%}$ = 2-5% cover) Buffer: 10% ($CI_{80\%}$ = 8-13% cover)

SR 161 Kapowsin (Year 2/5)		
	Hydrology present	Present
	50% emergent vegetation cover	81% ($CI_{90\%}$ = 73-89% cover)
	< 20% cover of invasive species in wetland	9% ($CI_{80\%}$ = 7-11% cover) (entire site)
	40% cover of trees on site	< 5% aerial cover
	20% cover of shrubs on site	< 5% aerial cover

SR 706 Ashford (Year 5/5)		
	35-50% scrub-shrub aerial cover & 50-65% emergent aerial cover	Scrub-shrub 11% ($CI_{80\%}$ = 8-14% cover) Emergent 82% ($CI_{95\%}$ = 76-88% cover)
	90% of species present are native	30% of species observed are native
	Increase in stormwater storage	Present
	Dense vegetation and flat grades	Present
	Buffer with 75% or greater survival	55-60% survival
	Wildlife presence	Observed
	Amphibian habitat and presence	Observed
	Hydrology and soil indicators	Unconfirmed
	Establishment of wildlife forage plant species	Present

List of Acronyms

Acronym	Meaning
CI	Confidence Interval (see Methods and Glossary)
ECY	Washington State Department of Ecology
FAC	Facultative Indicator Status (Reed 1988)
FACW	Facultative Wetland Indicator Status (Reed 1988)
IP	Individual Permit
MP	Mile Post
NWP	Nationwide Permit
OBL	Obligate Wetland Indicator Status (Reed 1988)
SR	State Route
USACE	United States Army Corps of Engineers
WDFW	Washington Department of Fish and Wildlife
WSDOF	Washington Department of Fisheries
WSDOT	Washington State Department of Transportation

Introduction

History
Infrastructure improvements including highway construction projects, highway interchanges, and bridges have accompanied economic and population growth in the state of Washington. The Washington State Department of Transportation (WSDOT) routinely evaluates the potential for degradation of critical areas that result from these infrastructure improvements. WSDOT strictly complies with applicable federal, state, and local environmental regulations, including the Clean Water Act and the state "no net loss" policy for wetlands (Executive Order 89-10). Generally, mitigation sites are planned when transportation improvement projects adversely affect critical areas. The WSDOT Wetland Assessment and Monitoring Program monitors these mitigation sites as a means of evaluating compliance with permit conditions and tracking overall development. Sixty-three sites statewide were monitored in 2003. Of the 26 sites included in this year's Annual Monitoring reports, 21 have standards to be addressed in 2003, and five are provided as a requested courtesy.

Purpose
The purpose of this document is to report the status of WSDOT Olympic Region mitigation sites with respect to permit compliance and success standards for 2003 (Map 1).[1] We rely on feedback from the users of this report to ensure its contents are clear, concise, and meaningful.

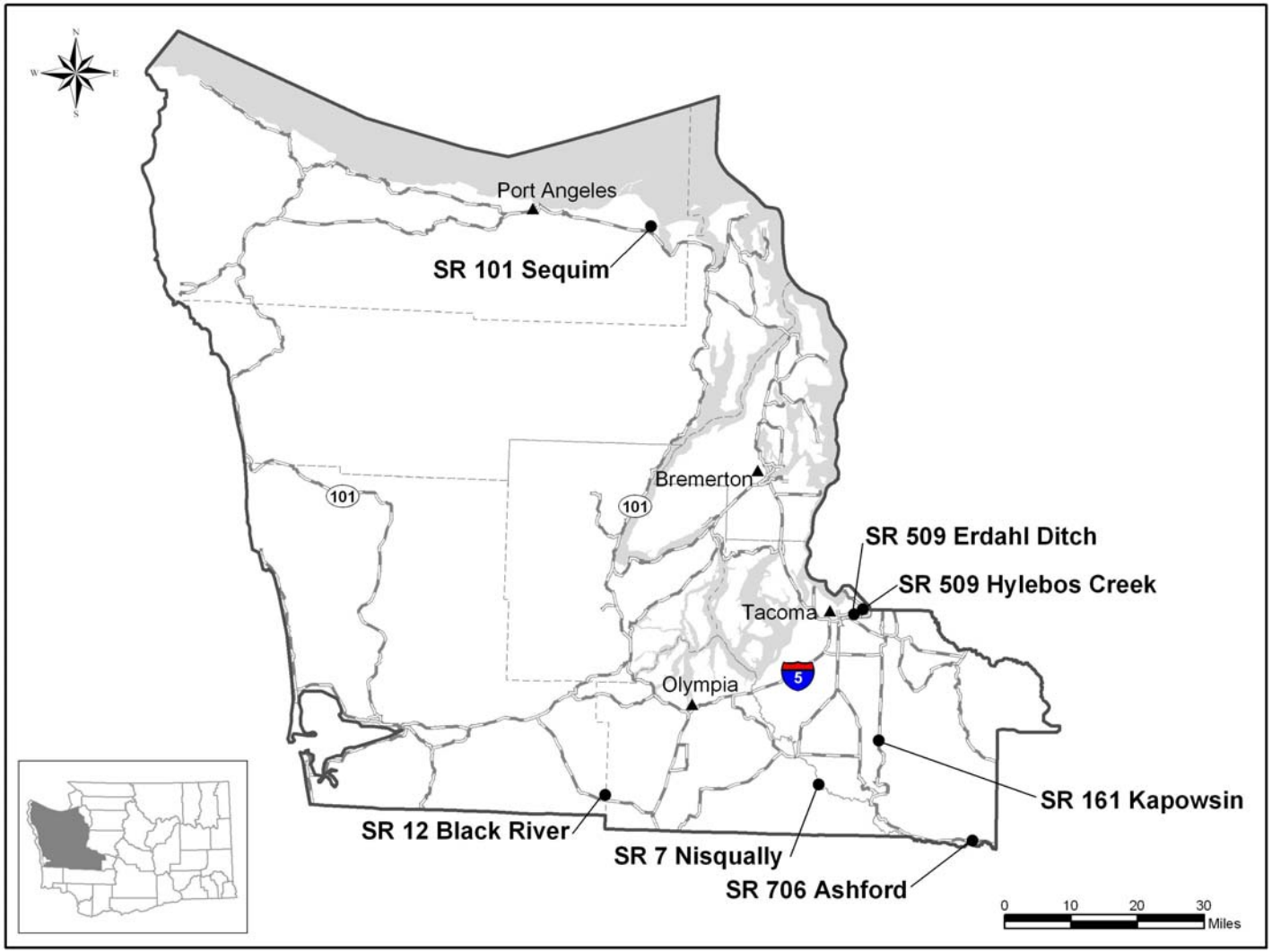
Process
Monitoring typically begins the first spring after a site is planted and continues for the time period designated by the permit or mitigation plan. The monitoring period generally ranges from three to ten years. In special cases sites may be monitored beyond the designated monitoring period.

Monitoring activities are driven by site-specific success standards detailed in the mitigation plan or permits. Data are collected on a variety of environmental parameters including vegetation, soils, hydrology, and wildlife. When data analysis is complete, information on site development is communicated to region staff to facilitate management activities as part of an adaptive management process. Monitoring reports are issued to regulatory agencies and published on the web at:

www.wsdot.wa.gov/environment/wetmon/default.htm

[1] Sites shown on the map without reports were evaluated for internal feedback only. A report is issued only for sites with success standards that apply to the current year.

Map 1: Olympic Region Sites Monitored in 2003



Methods

Methods used for monitoring mitigation sites change as site requirements and customer needs evolve. Quantitative data collection techniques presently in use are based on standard ecological and biostatistical methods.[2] The Wetland Program's current methods include the following key elements:

Objective-based Monitoring

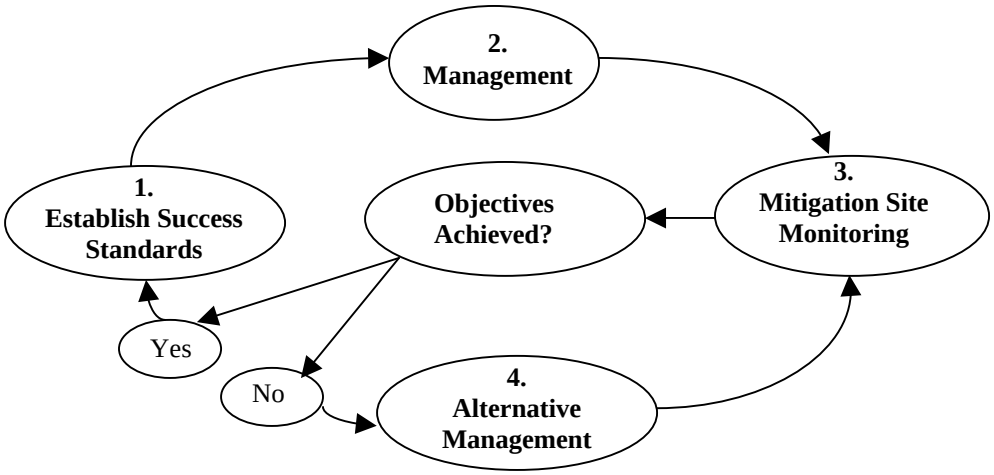
We collect data using a monitoring plan and sampling design developed specifically for each site. The monitoring plan and sampling design address success standards, permit requirements, contingencies, and other considerations as appropriate.

Adaptive Management

The adaptive management process includes four iterative steps:

1. success standards are developed to describe the desired condition,
2. management action is carried out to meet the success standard,
3. the response of the resource is monitored to determine if the success standard has been met, and
4. management is adapted if the standards are not achieved.

Monitoring is integral to the success of an effective adaptive management strategy. Without valid monitoring data, management actions may or may not result in improved conditions or compliance with regulatory permits. Timely decisions, based on valid monitoring data, result in increased efficiency and higher probabilities of success (Shabman 1995; Thom and Wellman 1996). The adaptive management process is illustrated in Figure 1.1.



(Redrawn from Elzinga et al. 1998)

Figure 1.1 The Adaptive Management Process

[2] These methods are based on techniques described in Bonham (1989), Elzinga et al. (1998), Krebs (1999), Zar (1999), and other sources.

Statistical Rigor

WSDOT's monitoring approach strives to minimize subjectivity in data collection and increase the reliability of data collection and analysis. Important considerations include appropriate sampling design, sampling resolution, random sampling procedures, and sample size analysis. Our goal is to provide customers with an objective evaluation of site conditions based on valid and reliable monitoring data.

Success Standards and Sampling Objectives

Site objectives and success standards are important elements of a mitigation plan. They indicate the desired state or condition of the mitigation site at a given point in time. Conditional permit requirements, if different from success standards in the mitigation plan, are also evaluated during monitoring activities. Some mitigation plans also provide contingencies if a specific undesirable condition occurs. Contingencies typically initiate a management response at the onset of a particular condition, for example, excessive cover by invasive species or insufficient cover by trees and shrubs.

Wetland Assessment and Monitoring Program staff thoroughly examine goals, objectives, success standards, and site permits to understand the desired site condition or characteristics to be measured. Six elements are sought in relation to each success standard to ensure measurability of the desired condition: species indicator, location, attribute, action, quantity/status, and time frame. Where one or more of the six elements is undocumented or unclear in the mitigation plan or permit, clarification is sought from region staff.

Success Standards are copied verbatim from the mitigation plan in the Success Standards and Sampling Objectives section of each site report. Differences in common usage of the terms *aerial* and *areal* has made their interpretation in mitigation plans difficult. We feel that the term *aerial* better describes the intent of the mitigation plans in most cases. Where we judge the word *areal* has been used arbitrarily in the Success Standards, we follow it with a (*sic*) notation. The Glossary defines the meaning of these words as used in this document.

Information presented in the first table of each site report is obtained directly from the mitigation plan and permits, as appropriate.

Sampling may be required to address success standards unless an efficient and reliable total accounting of the target attribute can be conducted. Sampling objectives are developed to guide the data collection process. Sampling objectives typically include a confidence level and confidence interval half width.

The results of sampling are included in the individual site reports with the confidence level and confidence interval noted as ($CI_X = Y_1$-Y_2), where CI = confidence interval, X = confidence level, and confidence interval width is expressed as Y_1 low estimate to Y_2 high estimate. For example, an estimated aerial cover provided by woody species reported as 65% ($CI_{80\%}$ = 52-78% aerial cover) means that we are 80% confident that the true aerial cover value is between 52% and 78% (Figure 1.2).

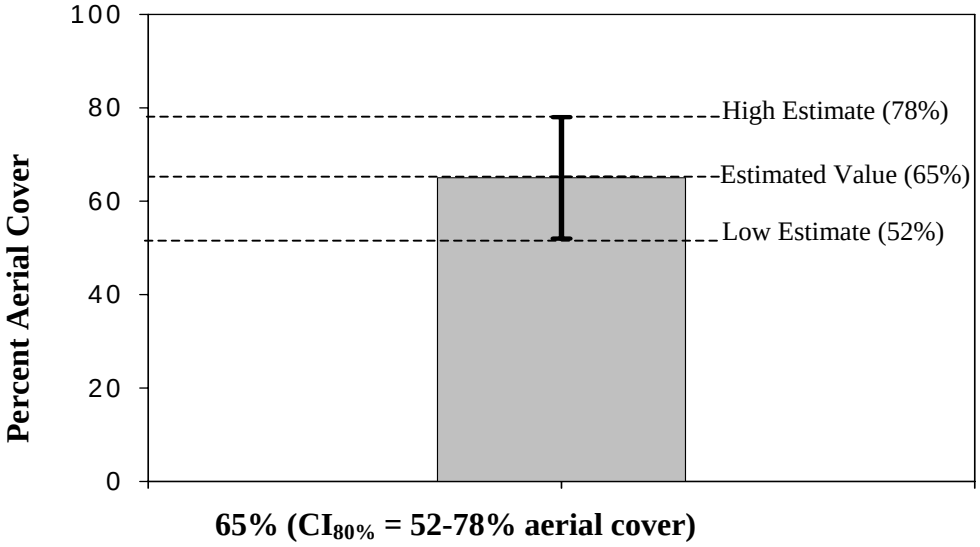


Figure 1.2 Estimated Cover Value Expressed with Confidence Interval Range

For compliance purposes, aerial cover calculations include only areas covered by rooted vascular plants (including floating-leaved species). Areas covered by thallophytes (algae, fungi, bacteria), bryophytes (mosses and liverworts), structures, or aquatic vegetation are not included in aerial cover calculations. Scientific names, most common names, and nativity used in this report were obtained from the *PLANTS Database* (USDA 2003). Hydrophytic plant indicator status was obtained from the *National List of Plant Species that Occur in Wetlands: Northwest* (Reed 1988 and 1993). Where invasive or noxious weeds are addressed, county specific listings in the *State Noxious Weed List* are referenced (Washington State Noxious Weed Control Board 2003).[3]

Sampling Design

When sampling is required, a sampling design is developed for the site or zone of interest. Sampling designs can vary from simple to complex depending on the number and type of attributes to be measured. Specific elements such as the size and shape of the site, the presence of environmental gradients, plant distribution patterns, and the amount of time and resources available for monitoring are factors that influence the sampling design. Elements of the sampling design may include the location of the baseline, orientation of transects (Figure 1.3), the method of data collection, and the number and type of sample units to be used. Depending on the sampling objective and site characteristics, transects may vary in number, length, and separation distance. Sampling transect locations are determined by using either a simple, systematic, stratified, or restricted random sampling method.

[3] In some cases, other nuisance species may be included in invasive cover estimates.

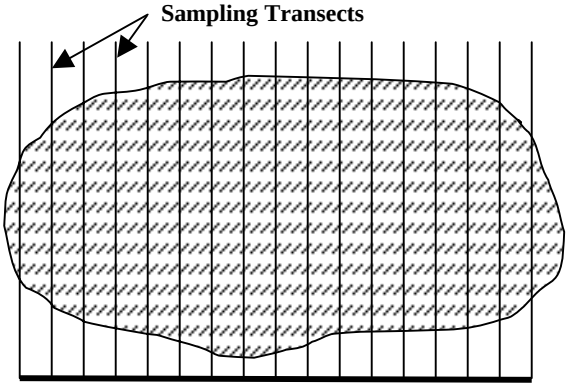


Figure 1.3 Baseline and Sampling Transects

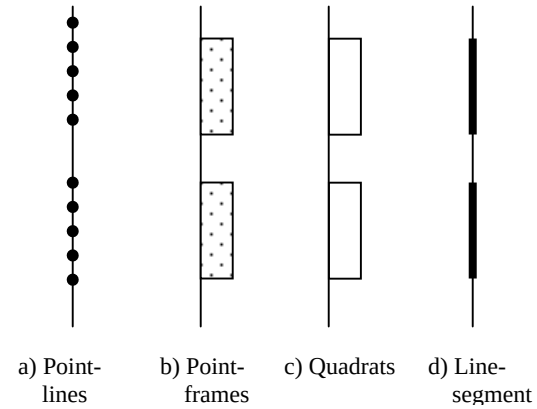


Figure 1.4 (a-d) Sampling Transects and Sample Units

A diagram showing the sampling design is typically included in mitigation site reports. Sample units appropriate to one or more of the methods described below are randomly located on or adjacent to the sampling transects (Figure 1.4 a-d). These drawings are general representations of the actual sampling designs and do not include specific details.

Point-Line Method

The point-line technique (Bonham 1989; Elzinga et al. 1998) can be used where vegetative cover is an attribute of interest. This method involves randomly locating sample units consisting of fixed sets of points along sampling transects (Figure 1.4a). Tools used to collect point-line data include point-intercept devices, pin flags, or densitometers. These tools are used to identify point locations. Target vegetation intercepted by the point locator is recorded. If target species are not encountered on the point; bare soil, non-vascular plant, or habitat structure is recorded as appropriate. For each sample unit, cover is determined based on the number of times target vegetation is encountered divided by the total number of points. For example, if invasive species were encountered on 20 points from a sample unit composed of 100 points, the aerial cover of invasive species for that sample unit is 20 percent.

Point-Frame Method

Point-frames are another tool that may be used to measure vegetative cover (Bonham 1989; Elzinga et al. 1998). A point-frame is a rectangular frame that encloses a set of points collectively serving as a sample unit (Figure 1.4b).[4] The sample unit is lowered over herbaceous vegetation and data is recorded where target vegetation intercepts point locations. As with the point-line method, a cover value for each sample unit is determined. For example, if FACW and OBL species were encountered on 20 points in a point-frame composed of 40 points, the aerial cover of FACW and OBL species for that point-frame sample unit is 50 percent.

[4] The WSDOT Wetland Assessment and Monitoring Program typically uses a frame formed with polyvinyl chloride (PVC). Strings span the frame lengthwise and points are marked on the strings using a standard randomization method.

Quadrat Method

To measure survival or density of planted trees and shrubs in an area, quadrat sample units are randomly located along sampling transects (Bonham 1989; Elzinga et al. 1998). Quadrat width and length are based on characteristics of the vegetative community and patterns of plant distribution. Quadrats are typically located lengthwise along sampling transects (Figure 1.4c). Plants within a quadrat are recorded as alive, stressed or dead. The success standard or contingency threshold can be addressed with a percent survival estimate of plantings, or a density per square meter of living plantings as appropriate. For example, if eight planted woody species were recorded as alive and two were recorded as dead in a sample unit measuring 1 x 20 meters, the survival of planted woody species for that sample unit would be 80%, and the density would be 0.4 live plants per square meter.

Line-Intercept Method

Cover data for the woody species community is often collected using the line-intercept method (Bonham 1989; Elzinga et al.1998).[5] Line-segments, serving as sample units, are randomly located along sampling transects (Figure 1.4d). All woody vegetation intercepting the length of each sample unit is identified and the length of each canopy intercept recorded. For each sample unit, the sum of the canopy intercept lengths is divided by the total length to calculate an aerial cover value. For example, if woody vegetation was encountered on 80 meters from a 100-meter sample unit, the aerial cover for that sample unit is 80 percent.

Sample Size Analysis

With each of the above methods, sample size analysis is performed in the field to ensure that an adequate number of sample units are obtained to report the data at the specified confidence level and interval. The mean percent aerial cover value and standard deviation are calculated from the data, and sample size analysis is conducted. For data reported in this document, the following sample size equation for estimating a single population mean or a population total within a specified level of precision was used to perform this analysis (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[6]
n = unadjusted sample size

A sample size correction to n is necessary for adjusting "point-in-time" parameter estimates.[7] It is the adjusted n value that reveals the number of sample units required to report the estimated mean value at a specified level of confidence.

[5] Depending on site conditions and other considerations, woody cover data may be collected using the point-line method and a densitometer.

[6] In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

[7] Adjusted n values found in this report were obtained using the algorithm for a one-sample tolerance probability of 0.90 (Kupper and Hafner 1989; Elzinga et al 1998).

Wildlife Monitoring

Many mitigation plans include goals and objectives that address wildlife. For these sites, wildlife monitoring is conducted to provide information to support the results of the vegetation monitoring. An example of an objective that triggers such wildlife monitoring is presented below:

> Objective - Wildlife
> Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of fruit-bearing shrubs and stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. Overall, creating an emergent and scrub-shrub wetland is intended to provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians.

Some success standards contain more specific reference to monitoring wildlife. In these cases, a variety of wildlife monitoring techniques (see sections below) are used to evaluate success. An example of such a success standard follows:

> Success Standard:
> Development of habitat diversity and structure will be determined by the diversity and numbers of wetland dependent species identified during the monitoring period. The sites will meet this objective if wildlife species that utilize wetlands for some or all of their habitat requirements are located.

Incidental wildlife observations are recorded during all site visits.

Bird Monitoring

Sites with goals, objectives or success standards addressing the avian community receive three to four bird surveys conducted during the breeding season (April through mid-July). The point count method (Ralph et al. 1993) is used to document species richness and relative abundance.

Species diversity indices (H) may be calculated from bird survey data using the Shannon-Wiener function (Krebs 1999). Results are expressed as a mean annual species diversity index.

$$H' = -\sum_{i=1}^{s} (p_i)(\log p_i)$$

H' = index of species diversity
s = number of species
p_i = proportion of sample belonging to ith species

The following *t* test is used to test the null hypothesis that diversity indices from different years are equal (Zar 1999).

$$t = \frac{H'_1 - H'_2}{S_{H'_1 - H'_2}}$$

H' = index of species diversity
$S_{H'_1 - H'_2}$ = standard error of the difference between species diversity indices H'_1 and H'_2

Amphibian Monitoring

Sites with goals, objectives, or standards referencing amphibians may be monitored using methods adapted from Olson et al. (1997). Methods may include funnel trapping on sites with a water depth of one decimeter or greater. Call surveys and area searches may be used to assess terrestrial components of sites without standing water. Incidental amphibian observations are recorded during other monitoring activities. Potential for amphibian habitat may be qualitatively assessed.

Hydrology Monitoring

Primary and secondary field indicators of wetland hydrology (ECY 1997) are recorded to address hydrology standards and to aid in future delineation efforts. Wetland mitigation sites are delineated in the spring following the last year of vegetation monitoring so the actual wetland area can be compared to the planned wetland area.

Clallam County Site

SR 101 Sequim, Clallam County

The following report summarizes monitoring activities completed by the Streamkeepers of Clallam County, Washington State Department of Transportation Wetland Assessment and Monitoring Program, and Olympic Region staff at the SR 101 Sequim mitigation site in 2002 and 2003. Data were obtained to address current and future success standards and monitoring requirements. Table 2.1 provides general site information and Table 2.2 summarizes this year's monitoring results.

Table 2.1 General Information for the SR 101 Sequim Mitigation Site

Project Name	SR 101 Sequim Bypass Corridor
USACE IP Number	96-4-00923
Mitigation Location	Off of West Sequim Bay Road, Clallam County
Township/Range/Section (impact)	T.30N/R.4W/S.23,24 and T.30N/R.3W/S.19,20,27,28,29,34
Monitoring Period	2001-2010
Year of Monitoring	3 of 10
Area of Project Impact	8.94 acres
Type of Mitigation	Preserve/Restore/Enhance
Area of Mitigation	57.45 acres

Table 2.2 Monitoring and Management Summary for the SR 101 Sequim Mitigation Site

Success Standards	2003 Results	Management Activities
Presence of wetland hydrology (2005)	Present	Installed additional ditch plug
Suitable breeding habitat for amphibians (2005)	Amphibians observed	Installed additional ditch plug and additional woody debris
Install a minimum of 5 snags as perch trees, 5 large woody debris piles and 10 bat boxes (2001)	Present	
Provide a riparian corridor along Bell Creek which provides some shade along a minimum of 40% of the stream (2010)	North bank: 48% South bank: 62%	Irrigation, installed browse guards
Exclude cattle from the mitigation site	Cattle not observed	

Objectives and Success Standards

The following objectives, success standards, and monitoring tasks for the SR 101 Sequim mitigation site were excerpted from the *Environmental Mitigation Plan State Route 101 Sequim Bypass Corridor* (Ward and Schlatter 1997) and the *USACE Permit 96-4-00923* (1998). Appendix A provides the complete text of the success standards and monitoring tasks for this project.

Objective 1
Restore 13.36 ha (33 acres) of the site to wetland conditions.

Success Standard 1
A minimum of 10.12 ha (25 acres) will be restored to wetland conditions as determined by a wetland delineation completed in Year 5.

> Monitoring Task
> The delineation shall confirm the presence of hydrology (2005). Hydrology will be monitored during the monitoring period.

Objective 2
Increase wildlife habitat types and diversity by providing habitat for amphibians, increase structural diversity for birds, and by installing habitat structures.

Success Standard 2a
By Year 5 the site will provide suitable breeding habitat for frogs and salamanders. Species presence will be documented by live capture of adults or larvae, or observation of adults, larvae or egg masses.

> Monitoring Task
> Use the appropriate technique depending upon the time of year. Egg mass surveys can be completed during the breeding season, or larvae can be trapped or dip-netted during the larval rearing season, or adults can be observed year-round or during the breeding season.

Success Standard 2b
Install by the end of Monitoring Year 1 a minimum of 5 snags as perch trees, a minimum of 5 large woody debris piles and at least 10 bat boxes.

> Monitoring Task
> Document presence at completion of construction. Locate structures on as-built plans. While no specific monitoring of use is required, visual inspection of each bat box for guano and inspection of the ground under each perch tree for whitewash and pellets during the site inspections should be done opportunistically.

> Monitoring Task
> Breeding bird surveys – sampling stations will be located in each desired vegetation/habitat zone (e.g. forested, emergent, riparian, etc.). Survey will be a simple presence of species census. Surveys will support Objective B.

Objective 3
Create and enhance fish habitat in Bell Creek.

Success Standard 3
Provide a riparian corridor along Bell Creek which provides some shade along a minimum of 40 percent of the stream corridor after 10 years (2010).

Monitoring Task
Measure the total length of the relocated creek, and measure length of all riparian areas supporting vegetation over three feet tall to determine percent of stream corridor which is shaded.

Monitoring Task
Aquatic macroinvertebrate sampling – invertebrates will be identified to Order for all individuals, and to family in the orders Ephemeroptera, Plecoptera, and Tricoptera. Surveys will be conducted to indirectly support Objective C.

Objective 4
Reduce the opportunity of the water in the on-site portion of Bell creek and in the on-site portion of the wetland to become polluted with nitrates from cow manure.

Success Standard 4
Exclude cattle from the mitigation site.

Monitoring Task
Visually inspect the site for cattle or signs of cattle intrusion.

Monitoring Task
Water quality testing. Sampling will support Objective D.

Methods

To address Success Standard 1, field indicators of wetland hydrology (ECY 1997) were recorded during site visits in March, April, and August 2003. These observations included areas of inundation and saturation.

Objective 2 addresses increasing wildlife habitat by providing habitat for amphibians, increasing structural diversity for birds, and by installing habitat structures. Amphibian surveys using live traps were conducted in the winter and spring of 2003 and point-count bird surveys have been conducted during spring site visits (Success Standard 2a and 2b). All species present in the amphibian traps (amphibians and incidental captures) were released in the field at the site of capture. General observations of site use by wildlife have been recorded during site visits.

Habitat structures were counted to verify their presence (Success Standard 2b). Visual inspection of each bat box for guano was conducted to address the use of the bat boxes (Success Standard 2b).

The riparian corridor along Bell Creek was measured by first measuring the total length of the relocated creek then measuring the length of all riparian areas supporting vegetation over two feet tall to determine percent of stream corridor which is shaded (Success Standard 3).

Aquatic macroinvertebrate samples were collected using a clam gun, dip net and surber sampler to address Objective 3. The sampled material was placed in labeled collection containers and brought back to lab for further identification.

Presence of cattle and signs of cattle intrusion were evaluated. To address the exclusion of cattle from the mitigation site (Success Standard 4), Streamkeepers of Clallam County conducted the water quality testing for nitrates using Hach test strips.

Results and Discussion

Success Standard 1 – Presence of Wetland Hydrology (2001-2010)
In April and May 2003, saturation was observed throughout the site. On the west half of the site, small areas were inundated up to two decimeters. Water was present in the ponds, Bell Creek, and the ditches throughout the site during both of the spring visits and at the beginning of June and end of August. Some saturation was observed on the northeast portion of the site in August. This data suggests that wetland hydrology was present in 2003.

Success Standard 2a – Suitable Breeding Habitat for Amphibians
Five amphibian species were observed during surveys and site visits in 2003. Table 2.3 shows the species and life stages that were present. These results suggest that the site provides suitable amphibian breeding and rearing habitat.

Table 2.3 SR 101 Sequim Mitigation Site Amphibian Survey Results

Species	Adult	Juvenile	Larvae	Egg Mass
Pacific chorus frog (*Pseudacris regilla*)	X			
Cope's giant salamander (*Dicamptadon copei*)	X			
Northwestern salamander (*Ambystoma gracile*)	X	X		
Red-legged frog (*Rana aurora*)	X	X		X
Rough-skinned newt (*Taricha granulose*)	X		X	

Success Standard 2b – Minimum 5 Snags, 5 Woody Debris Piles, and 10 Bat Boxes
All of the snags, woody debris piles, and bat boxes were present in August. Two bat boxes had guano under them. The snags, woody debris piles, bat boxes, and the planted woody species have all been documented as perching areas for various species of birds. Red-tailed Hawks have been seen perching on snags several times during site visits throughout the monitoring period.

During the monitoring period, data from formal bird surveys and incidental observations have documented a total of 49 bird species from 24 families on the site. Nine of the 49 species observed are wetland dependent and 10 are wetland associated (Table 2.4). In addition, both female and male Mallards with ducklings have been observed on the pond. It appears that the site is providing habitat for a variety of bird species.

Table 2.4 SR 101 Sequim Mitigation Site Bird Status

Common Name	Scientific Name	Status[8]
Bald Eagle	*Haliaeetus leucocephalus*	Wetland-associated
Barn Swallow	*Hirundo rustica*	Wetland-associated
Black-capped Chickadee	*Poecile atricapillus*	Wetland-associated
Belted Kingfisher	*Ceryle alcyon*	Wetland-dependent
Blue-winged Teal	*Anas discors*	Wetland-dependent
Canada Goose	*Branta canadensis*	Wetland-dependent
Common Yellowthroat	*Geothlypis trichas*	Wetland-dependent
Gadwall	*Anas strepera*	Wetland-dependent
Great Blue Heron	*Ardea herodias*	Wetland-dependent
Mallard	*Anas platyrhynchos*	Wetland-dependent
Marsh Wren	*Cistothorus palustris*	Wetland-dependent
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Wetland-associated
Red-winged Blackbird	*Agelaius phoeniceus*	Wetland-dependent
Tree Swallow	*Tachycineta bicolor*	Wetland-associated
Violet-green Swallow	*Tachycineta thalassina*	Wetland-associated
Warbling Vireo	*Vireo gilvus*	Wetland-associated
Willow Flycatcher	*Empidonax traillii*	Wetland-associated
Wilson's Warbler	*Wilsonia pusilla*	Wetland-associated
Yellow Warbler	*Dendroica petechia*	Wetland-associated

Success Standard 3 – Forty Percent Riparian Corridor Along Bell Creek (2010)

Bell Creek is approximately 624 meters long, and currently supports woody vegetation taller than two feet along 297 meters of the north bank and 386 meters on the south bank. Forty-eight percent of the north bank and 62% of the south bank has woody vegetation of any height present. The riparian corridor on the west end of the creek is taller than the east end (Figure 1). Most of the cover is provided by *A. rubra*. The standard requires that 40% of the creek has a riparian corridor of trees over three feet tall by 2010. These results suggest that this success standard will be met before 2010.

Figure 2.1 SR 101 Sequim Mitigation Site (August 2003)

[8] Wetland-dependent and wetland-associated species status is based on Brown and Smith (1998), and is modified for regional variation using Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

Other Observations

Aquatic macroinvertebrate sampling provided information to support Objective 3 (creating and enhancing fish habitat in Bell Creek). Typically, the Orders Diptera (often associated with sedimentation and elevated stream temperatures) and Isopoda indicate poor quality streams, and the Orders Ephemeroptera, Plecoptera, and Trichoptera (EPT) indicate higher quality streams. Many Isopoda and Diptera individuals were identified on the site. In addition, three families from the Order Trichoptera and one family each from the Orders Ephemeroptera and Plecoptera were identified on site between 2002 and 2003 (Table 2.5). This species composition is common when there has been a physical alteration of the stream channel or surface water. Since Bell Creek was relocated, the riparian area planted with trees, and the ponded areas were created, we expect that a decrease in Diptera and an increase in Ephemeroptera, Plecoptera Trichoptera (EPT) should occur over the next couple of years. The data collected throughout the monitoring period will be used to address an increase in food chain support and the overall site development during the monitoring period.

Table 2.5 SR 101 Sequim Mitigation Site EPT Families and Collection Location

Order	Family	Stream	Pond
Ephemeroptera	Baetidae	X	X
Plecoptera	Nemouridae	X	
Trichoptera	Lepidostomatidae	X	
Trichoptera	Limnephilidae	X	
Trichoptera	Hydroptilidae		X

Success Standard 4 - Exclude Cattle from the Mitigation Site

Fencing appears to have successfully excluded cattle from the site. Since cow manure can contribute a large amount of nitrates to water sources, nitrate testing was conducted as supporting information. Nitrate levels were low (ranging from zero to two parts per million) during each field spot check.

Management Activities

Ongoing management has focused on the planted woody species and weed control. Several test plots have been developed to get an understanding of the best ways to achieve woody species establishment and control invasive species at the site. Control of invasive species is starting to focus more on mechanical methods instead of chemical control. Table 2.6 provides a summary of management activities conducted in 2003.

Table 2.6 SR 101 Sequim Mitigation Site 2003 Management Summary

Focus	Type of Management	Dates Conducted (2003)
Woody Species	Replanting	February, December
	Irrigation/watering	April, June, July, August, September
	Install browse/rodent guards/bark collars	February, April, June, December
	Fertilization	February, October
	Polymer application	February, April
Invasive Species	Mechanical: mowing, brush cutting, rototilling, hand pulling	April, May, June, August, September
	Chemical: selective application	May, June, August, September
	Biological • *Rhinocyllus conicus*: *Cirsium* (thistle) head weevil • *Larinus planus*: *Cirsium arvense* (Canada thistle) bud weevil • *Agonopterix alstroemeriana*: *Conium maculatum* (poison hemlock) moth	June
	Removal of *Rorippa nasturtium-aquaticum* (watercress) from Bell Creek	July, August, September
Woody Debris	Installed additional instream woody debris in Bell Creek for fish habitat	August
Hydrology	Installed additional ditch plug to help with saturation in the wetland	August
	Hydroseeded disturbed area from the installation of the ditch plug)	October

Pierce County Sites

SR 7 Nisqually Slough, Pierce County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 7 Nisqually Slough mitigation site in August 2003. Monitoring data were obtained to compare to second-year success standards. Activities include surveys of the plant communities and hydrology observations. Table 3.1 provides general site information and Table 3.2 summarizes this year's monitoring results.

Table 3.1 General Information for the SR 7 Nisqually Slough Mitigation Site

Project Name	SR 7 MP 40 to MP 42.5
USACE NWP Permit Number	2000-4-00954
Mitigation Location	South of Wilcox Farms near the Nisqually River, Pierce County
Township/Range/Section (impact)	T.18N/R.3E/S.24, 25, 36
Monitoring Period	2002 to 2006
Year of Monitoring	2 of 5
Area of Project Impact	0.75 acres
Type of Mitigation	Wetland Creation
Area of Mitigation	0.82 acres

Table 3.2 Monitoring and Management Summary for the SR 7 Nisqually Slough Mitigation Site

Success Standards	2003 Results[9]	Management Activities
1. Hydrology present	Present	
2. $\leq$ 20% cover by invasive species in the wetland or buffer	Wetland: 4% ($CI_{80\%}$ = 2-5% cover) Buffer: 10% ($CI_{80\%}$ = 8-13% cover)	Weed control

Success Standards and Sampling Objectives

Second-year success standards for the SR 7 Nisqually Slough mitigation site were excerpted from the *SR 7 MP 40 to MP 42.5 Wetland Mitigation Plan* (Russell 1999). A companion sampling objective follows the success standard, where applicable. Appendix B provides the complete text of the success standards for this project.

Success Standard 1
Cover of reed canarygrass, or other invasive species may not exceed 20 percent of the total wetland or buffer area at any time during years one through five (2002-2006).

[9] Estimated values are presented with their corresponding statistical confidence interval. For example, 4% ($CI_{80\%}$ = 2-5% cover) means we are 80% confident that the true aerial cover value is between 2% and 5 percent.

Sampling Objective 1a
To be 80% confident the true aerial cover of invasive species in the wetland is within 20% of the estimated value.

Sampling Objective 1b
To be 80% confident the true aerial cover of invasive species in the buffer is within 20% of the estimated value.

Success Standard 2
Hydrology (within 12 inches of the soil surface) within the wetland creation area must be present for at least 12.5% of the growing season (consecutively) (2003).

Methods

To evaluate aerial cover of invasive species, 28 temporary transects were placed perpendicular to a center baseline using a systematic random sampling method (Figure 3.1). Fifty-three 12-meter point-line sample units (48 points each) were randomly positioned along sampling transects in the wetland creation area. Fifty-eight 12-meter sample units (48 points each) were randomly positioned in the upland (Success Standard 1).

WSDOT personnel recorded primary and secondary field indicators of wetland hydrology (ECY 1997) observations in May and June 2003.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[10]
n = unadjusted sample size

Incidental wildlife observations are recorded during all site visits.

For additional details on the methods described above, see the Methods section of this report.

[10] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

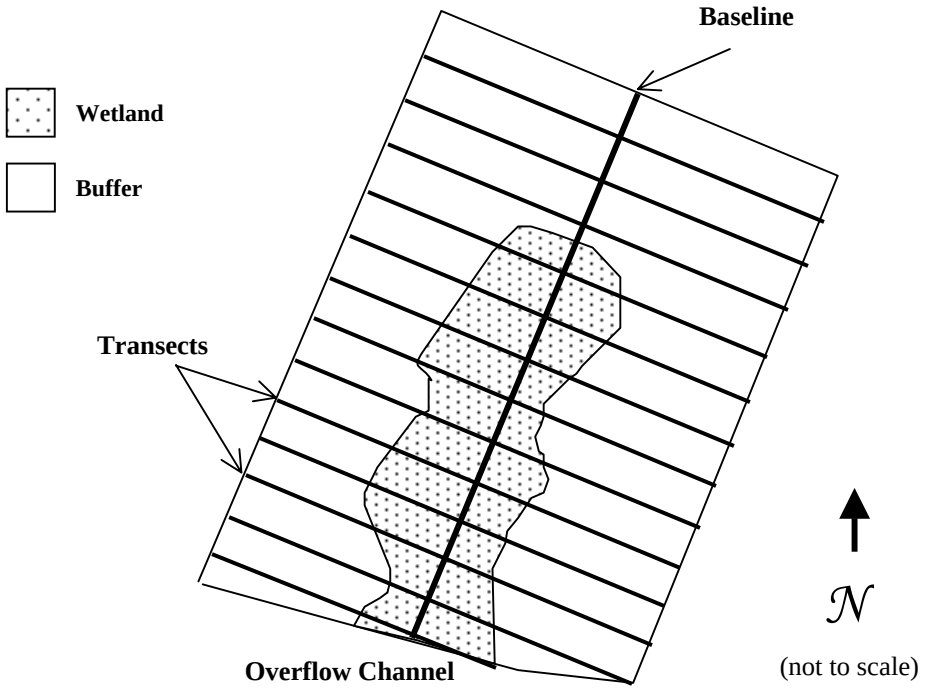


Figure 3.1 SR 7 Nisqually Slough Mitigation Site Sampling Design (2003)

Results and Discussion

Success Standard 1a – Maintain Less Than 20% Invasive Species in the Wetland
The aerial cover of invasive species in the wetland was estimated to be 4% ($CI_{80\%}$ = 2-5% cover). This estimate indicates cover by invasive species is less than the maximum allowed by the standard. *Phalaris arundinacea* (reed canarygrass) and *Iris pseudacorus* (yellow flag iris) were observed encroaching onto the southern edge of the wetland and adjacent to the overflow channel. Other invasive species scattered across the wetland include *Cirsium* species (thistles), *Cytisus scoparius* (Scot's broom), *Leucanthemum vulgare* (oxeye daisy), *Rubus armeniacus* (Himalayan blackberry), and *Tanacetum vulgare* (common tansy).

Success Standard 1b – Maintain Less Than 20% Invasive Species in the Buffer
The aerial cover of invasive species in the buffer was estimated to be 10% ($CI_{80\%}$ = 8-13% cover). This estimate indicates cover by invasive species is less than the maximum allowed by the standard. *Rubus armeniacus* and *P. arundinacea* were observed encroaching into the edge of the buffer at the southern end of the site near the overflow channel.

Success Standard 2 – Wetland Hydrology

Hydrology monitoring visits in mid-May documented saturation to the surface throughout the wetland area. Observations in June 2003 indicate that there was saturation to the surface in 20% of the created wetland. This suggests that the site may meet the wetland hydrology requirement this year.

Other Observations

Substantial portions (20% qualitative estimate) of the wetland area were covered with a carpet of volunteer *Populus balsamifera* (black cottonwood) less than one decimeter in height. In the northern portion of the wetland a few patches of *Alnus rubra* (red alder) one to two decimeters in height were observed. These volunteers may provide increased woody cover in future monitoring years.

Figure 3.2 SR 7 Nisqually Slough Mitigation Site (August 2003)

Management Activities

A three-wire fence was installed around site in the spring of 2003 in order to prevent vandalism but allow wildlife movement. Chemical and mechanical weed control measures targeted invasive species on three visits over the summer. Woody plantings were irrigated twice over the dry summer months. Woody species were replanted in late October 2003 in order to replace dead plants and increase future woody cover.

SR 161 Kapowsin, Pierce County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 161 Kapowsin mitigation site in August 2003. Monitoring data were obtained to compare to second-year success standards. Activities included vegetation surveys and hydrology observations. Table 4.1 provides general site information and Table 4.2 summarizes this year's monitoring results.

Table 4.1 General Information for the SR 161 Kapowsin Mitigation Site

Project Name	MP 13 to MP 14 Safety Improvement (Junction Kapowsin Highway)	
USACE NWP Permit Number	93-4-01100	
Mitigation Location	West side of SR 161 just South of the SR 161 / South Fork Muck Creek Crossing, Pierce County	
Township/Range/Section (impact)	T.17N/R.04E/S.3, 4	
Monitoring Period	2002 to 2006	
Year of Monitoring	2 of 5	
Area of Project Impact	0.16 acres	
Type of Mitigation	Wetland Creation/Enhancement	Buffer Enhancement
Area of Mitigation	0.32 acres	0.32 acres

Table 4.2 Monitoring and Management Summary for the SR 161 Kapowsin Mitigation Site

Success Standards	2003 Results[11]	Management Activities
1. Hydrology present	Present	
2. 50% emergent vegetation cover	81% ($CI_{90\%}$ = 73-89% cover)	
3. < 20% cover of invasive species in wetland	9% ($CI_{80\%}$ = 7-11% cover) (entire site)	Weed control
4. 40% cover of trees on site	< 5% aerial cover	Replanting
5. 20% cover of shrubs on site	< 5% aerial cover	Replanting

Success Standards and Sampling Objectives

Second-year success standards for the SR 161 Kapowsin mitigation site were excerpted from the *MP 13 to MP 14 Safety Improvements (Junction Kapowsin Highway Vicinity Mitigation Plan)* (Russell 1998). A companion sampling objective follows the success standards where appropriate. Appendix C provides the complete text of the success standards.

[11] Estimated values are presented with their corresponding statistical confidence interval. For example, 81% ($CI_{90\%}$ = 73-89% aerial cover) means we are 90% confident that the true aerial cover value is between 73 and 89 percent.

Success Standard 1
Hydrology (within 12 inches of the soil surface) within the wetland creation area must be present for at least 12.5% of the growing season (consecutive) (2003).

Success Standard 2
At least 50% emergent cover on site in year two (2003).

> Sampling Objective 2
> To be 80% confident the true aerial cover of FAC and wetter herbaceous species on site is within 20% of the estimated value.

Success Standard 3
Cover of reed canarygrass, or other invasive species may not exceed 20 percent of the total wetland area at any time during years one through five (2002-2006).

> Sampling Objective 3
> To be 80% confident the true aerial cover value of invasive species on site is within 20% of the estimated value.

Success Standard 4
At least 20% tree cover on site in year two (2003).

Success Standard 5
At least 40% shrub cover on site in year two (2003).

Methods

Primary and secondary field indictors of wetland hydrology (ECY 1997) were recorded during two site visits in May 2003 (Success Standard 1).

Quantitative vegetation sampling was conducted in August 2003. Eighteen temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 4.1). To address emergent species cover in Success Standard 2, 36 point-line sample units were randomly located along sampling transects. To address invasive species cover in Success Standard 3, 17 point-line sample units were similarly located.

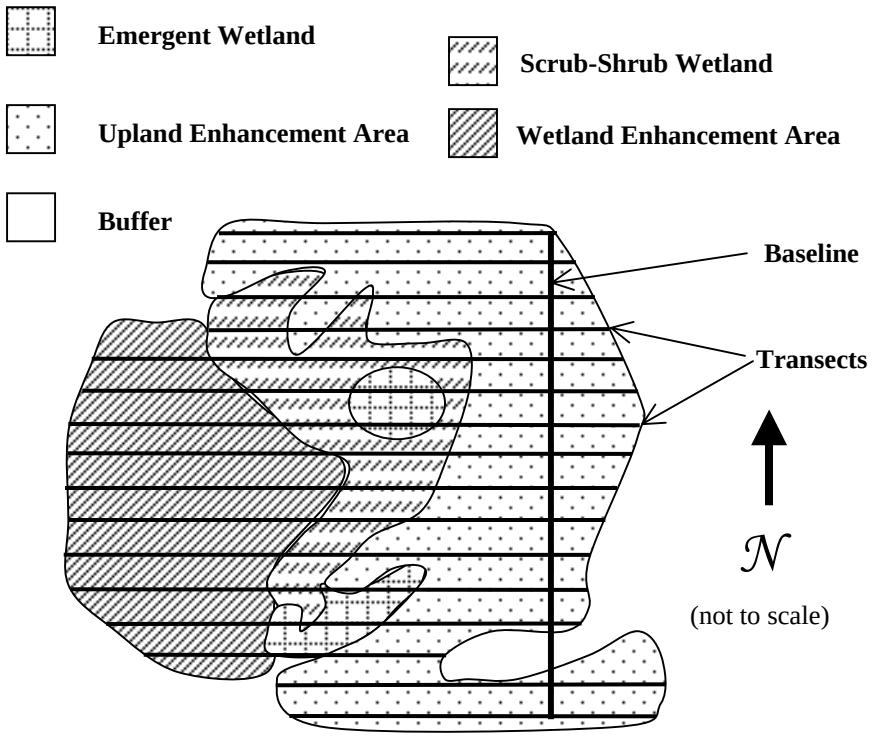


Figure 4.1 SR 161 Kapowsin Mitigation Site Sampling Design (2003)

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[12]
n = unadjusted sample size

Qualitative assessments were made of tree and shrub cover due to the high mortality and low woody cover present in the planted areas (Success Standards 4 and 5).

For additional details on the methods described above, see the Methods section of this report.

[12] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Results and Discussion

Success Standard 1 – Wetland Hydrology

Hydrology observations were documented during two site visits in May 2003. Saturation to the surface in the low areas of the site was noted during each visit. The site is also clearly dominated by hydrophytic vegetation. These observations suggest that this site has achieved the hydrological conditions prescribed in Success Standard 1 this year.

Success Standard 2 – At Least 50% Emergent Vegetation Cover on Site

The aerial cover of facultative or wetter species on site is 81% ($CI_{90\%}$ = 73-89% cover). This exceeds the 50% cover criteria in Success Standard 2. A diverse mix of herbaceous hydrophytes is present in the wetland areas of the site as shown in Table 4.3.

Table 4.3 Emergent Species Observed on the SR 161 Kapowsin Mitigation Site (2003)

Scientific Name	Common Name	Facultative Status
Argentina anserina	silverweed cinquefoil	OBL
Carex obnupta	slough sedge	OBL
Carex stipata	sawbeak sedge	OBL
Eleocharis species	spike-rushes	OBL
Epilobium ciliatum	fringed willowherb	FACW
Juncus acuminatus	tapertip rush	OBL
Juncus articulatus	jointleaf rush	OBL
Juncus effusus	soft rush	FACW
Juncus ensifolius	daggerleaf rush	FACW
Juncus tenuis	slender rush	FACW
Scirpus microcarpus	small-fruited bulrush	OBL

Success Standard 3 – Less Than 20% Cover of Invasive Species in the Wetland

Invasive species cover on site at the time of monitoring was estimated to be 9% ($CI_{80\%}$ = 7-10% cover). *Rubus armeniacus* (Himalayan blackberry) contributes the majority of this cover while other species are present at trace levels. This meets the requirement specified in Success Standard 3.

Success Standard 4 and 5 – 20% Tree Cover and 40% Shrub Cover on the Site

In August, most tree and shrub plantings were stressed or dead. A qualitative estimate of combined planted and volunteer tree and shrub cover on site was less than five percent. This does not meet the success criteria prescribed in Success Standards 4 and 5. There is, however, substantial natural recruitment of several native species including *Alnus rubra* (red alder), *Populus balsamifera* (black cottonwood), and *Fraxinus latifolia* (Oregon ash). The site was also replanted in October as described in the management activities below. If volunteer and planted materials become successfully established, the site may achieve future success criteria within the prescribed monitoring period.

Management Activities

In July 2003, crews applied herbicides to *Rubus* species (blackberries), *Cirsium* species (thistles), and *Phalaris arundinacea* (reed canarygrass) on site. The following species were planted in October 2003 with mulch, fertilizer, and a gel polymer:

Acer macrophyllum (bigleaf maple)
Fraxinus latifolia (Oregon ash)
Populus balsamifera (black cottonwood)
Pseudotsuga menziesii (Douglas-fir)
Rubus spectabilis (salmonberry)
Thuja plicata (western red cedar)
Cornus sericea (redosier dogwood)

SR 706 Ashford, Pierce County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 706 Ashford mitigation site in July 2003. Monitoring data were obtained to compare to fifth-year success standards. Activities include surveys of vegetation, soils, hydrology, and wildlife. Table 5.1 provides general site information and Table 5.2 summarizes this year's monitoring results.

Table 5.1 General Information for the SR 706 Ashford Mitigation Site

Project Name	SR 706 305th Ave. to Anderson/Kernahan Road	
USACE NWP Permit Number	95-4-00282	
Mitigation Location	SR 706 East of Ashford, Pierce County	
Township/Range/Section (impact)	T.15N/R6E/S.25, 26, and 27	
Monitoring Period	1999 to 2003	
Year of Monitoring	5 of 5	
Area of Project Impact	0.32 acres	
Type of Mitigation	Wetland Creation	Buffer
Area of Mitigation	0.60 acres	1.42 acres

Table 5.2 Monitoring and Management Summary for the SR 706 Ashford Mitigation Site

Success Standards	2003 Results[13]	Management Activities
1. 35-50% scrub-shrub aerial cover & 50-65% emergent aerial cover	Scrub-shrub 11% ($CI_{80\%}$ = 8-14% cover) Emergent 82% ($CI_{95\%}$ = 76-88% cover)	Replanted
2. 90% of species present are native	30% of species observed are native	Weed Control
3. Increase in stormwater storage	Present	
4. Dense vegetation and flat grades	Present	
5. Buffer with 75% or greater survival	55-60% survival[14]	Replanted
6. Wildlife presence	Observed	
7. Amphibian habitat and presence	Observed	
8. Hydrology and soil indicators	Unconfirmed	
9. Establishment of wildlife forage plant species	Present	

[13] Estimated values are presented with their corresponding statistical confidence interval. For example, 11% ($CI_{80\%}$ = 8-14% aerial cover) means we are 80% confident that the true aerial cover value is between 8% and 14 percent.

[14] Plant mortality, re-planting, and natural recruitment often confound results if survival is quantified long after initial plant establishment. A qualitative estimate was made of survival.

Success Standards and Sampling Objectives

Fifth-year success standards for the SR 706 Ashford mitigation site were excerpted from the *Wetland Mitigation Plan Supplement for Pierce County Wetland Regulations SR 706 305th Ave to Anderson/Kernhan Rd Conceptual Wetland Mitigation Plan* (WSDOT 1995). A companion sampling objective follows the success standards where applicable. Appendix D provides the complete text of the success standards for this project.

Success Standard 1a and 1b
After five years the wetland portion of the site will have about 35-50% palustrine scrub-shrub (1a) and 50-65% palustrine emergent (1b) wetland area as measured by aerial coverage (2003).

> Sampling Objective 1a and 1b
> To be 80% confident the true aerial cover of scrub-shrub (1a) and emergent (1b) wetland are within 20% of the estimated values.

Success Standard 2
After five years approximately 90% of the species present should be native species. (2003).

> Sampling Objective 2
> To be 80% confident the true aerial cover for native species is within 20% of the estimated value.

Success Standard 3
An increase in potential stormwater storage will be confirmed by as-built surveys of the creation site following construction (2003).

Success Standard 4
Establishment of dense stands of vegetation and flat grades to facilitate flow attenuation, nutrient and sediment retention, and capability for groundwater recharge. Will meet standard if grade is per plan and Vegetation Performance Standards are met (2003).

Success Standard 5
Soil saturation at or near the surface in most years as indicated by the development of hydric soil characteristics (2003).

Success Standard 6
Buffer planted per plan with greater than 75% survival of planted species over 5 years (2003).

Success Standard 7
Establishment and growth of the species planted that were in part selected to provide a food resource for wildlife species (2003).

Success Standard 8
The presence of wildlife species utilizing the site will be noted during the monitoring visits. Recording of mammals will be through incidental observation of individuals or signs. Stable or increasing presence of wetland dependent bird species during the bird surveys will indicate utilization by the target species (2003).

Success Standard 9
Development of amphibian habitat, principally terrestrial foraging habitat. Some breeding habitat may be established for species that do not exclusively use deep open water areas such as the Pacific treefrog. Positive indicator of success include on-site verification of presence, and successful establishment of wetland habitat (2003).

Success Standard 10
Site development per plan (2003).

Methods

A baseline was established parallel to SR 706 along the south edge of the site to facilitate vegetative data collection. Twenty-eight temporary sampling transects were placed perpendicular to the baseline using a systematic random sampling method (Figure 5.1).

Aerial[15] cover estimates of scrub-shrub and emergent vegetation in the intended wetland (Success Standard 1) were obtained by randomly placing 36 point-line sample units, 20 meters in length (80 points each), in the wetland area. A Trimble GPS unit was used to determine the *area* of the scrub-shrub and emergent zones (Success Standard 1).

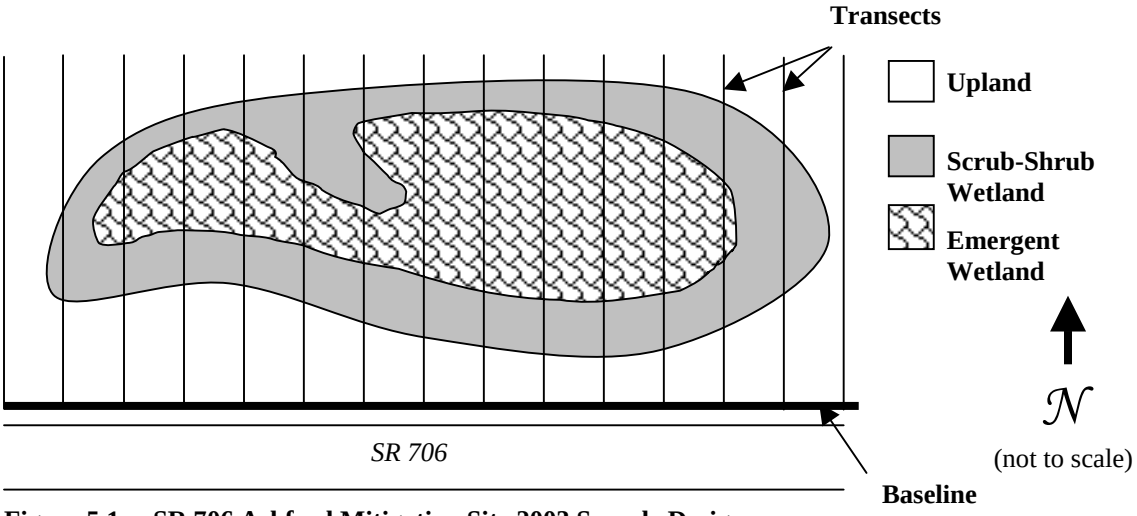


Figure 5.1 SR 706 Ashford Mitigation Site 2003 Sample Design

[15] Definitions of the terms *aerial* and *areal* cover as they are used in this report are included in the Glossary.

An estimate of native species cover (Success Standard 2) was obtained by randomly placing 28 point-line sample units, 45 meters in length (90 points each), along sampling transects over the entire site. A species list was compiled to further address the nativity of plant species found onsite.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[16]
n = unadjusted sample size

A review of site plans and verification of current site conditions were conducted to assess the increase in potential stormwater storage capacity on site (Success Standard 3).

Qualitative site observations assessed the establishment of dense stands of vegetation and flat grades to facilitate flow attenuation, nutrient and sediment retention, and capability for groundwater recharge (Success Standard 4).

To evaluate the hydric soil requirement in Success Standard 5, soil pits were excavated and hydrology indicators were recorded during site visits in March and April.

A qualitative assessment of survival was performed in the buffer due to uncertainties inherent in quantifying survival five years after original plant establishment and subsequent replanting (Success Standard 6).

A qualitative assessment was conducted to evaluate plant establishment and growth of species intended to provide a food resource for wildlife species (Success Standard 7).

Three 10-minute breeding bird surveys were conducted in 2001 and 2003 (Success Standard 8). The point count method (Ralph et al. 1993) was used with values recorded for both species richness and relative abundance. Species diversity indices (H) were calculated for each of the data sets using the Shannon-Wiener function (Krebs 1999). A mean annual species diversity index was calculated.

$$H' = -\sum_{i=1}^{s} (p_i)(\log p_i)$$

H' = index of species diversity
s = number of species
p_i = proportion of sample belonging to ith species

The following t test was used to test the null hypothesis that diversity indices from 2001 and 2003 are equal (Zar 1999).

[16] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

$$t = \frac{H'_1 - H'_2}{S_{H'_1 - H'_2}}$$

H' = index of species diversity
$S_{H'_1 - H'_2}$ = standard error of the difference between species diversity indices H'_1 and H'_2

The presence of wildlife species using the site was also noted during monitoring visits each year (Success Standard 8).

A habitat assessment was conducted to determine the site's suitability for amphibians (Success Standard 9). The site was also monitored on two occasions for amphibian presence by installing overnight traps (March and April).

Site plans were compared to current conditions to determine whether the site was constructed and is developing according to plan (Success Standard 10).

For additional details on the methods described above, see the Methods section of this report.

Results and Discussion

Due to a difference in popular usage of the terms *areal* and *aerial* cover, more than one interpretation may be offered for Success Standards 1a and 1b. To accommodate two different interpretations, the scrub-shrub and emergent zones were measured in terms of their *areal* and *aerial* coverage in 2003 and reported below. Definitions of these terms as they are used in this report are included in the Glossary.

Success Standard 1a – 35-50% Scrub-Shrub as Measured by Aerial Cover
Area estimates for the scrub-shrub and emergent zones are 0.38 acres each. This indicates that the site was implemented to plan with 50% scrub-shrub wetland and 50% emergent wetland. The estimated aerial cover of scrub-shrub vegetation in the wetland is low at 11% ($CI_{80\%}$ = 8-14% cover). Use by elk (*Cervus elaphus*) and black-tailed deer (*Odocoileus hemionus*) has slowed the development of scrub-shrub vegetation. Browse has kept much of the planted material at less than a meter in height, limiting cover and intended scrub-shrub functions.

Success Standard 1b – 50-65% Emergent as Measured by Aerial Cover
The *area* of the intended emergent zone is 0.38 acres (50%), however, the *aerial* cover of emergent vegetation (FAC and wetter) was estimated to be 82% ($CI_{99\%}$ = 74%-90% cover). This suggests that in the absence of a rapidly developing scrub-shrub community, a hydrophytic herbaceous plant community has become established.

Success Standard 2 – 90% of Species Present Native
There were 47 plant species observed at the site in 2003 (Appendix E). Eighteen of these were native (38%) and 29 were non-native. The aerial cover of native species on site was estimated to be 42% ($CI_{90\%}$ = 35-49% cover). These data show that native plants constitute a sizable component of the overall species composition, but do not achieve the

90% requirement. *Elymus repens* (quackgrass), *Festuca rubra* (red fescue), and *Holcus lanatus* (common velvetgrass) are widespread grass species that provide a substantial portion of the non-native cover at this site.

Success Standard 3 – Increase in Stormwater Storage

A comparison of site plans with current conditions confirms that the site was graded according to plan. The increase in potential stormwater storage as detailed in the site grading plan satisfies Success Standard 3.

Success Standard 4 – Establishment of Dense Vegetation and Flat Grades

Though the woody cover standard has not been achieved in the scrub-shrub area, the grade of the site is consistent with plan specifications and dense herbaceous vegetation is present throughout the site. Establishment of this vegetation is likely sufficient to satisfy the objectives associated with Success Standard 4. These objectives include dense vegetation, flat grades to facilitate flow attenuation, nutrient and sediment retention, and capability for groundwater recharge.

Success Standard 5 – Wetland Hydrology and Soil Indicators

The achievement of wetland hydrology and soil requirements cannot be confirmed with 2003 data. Inundation to two decimeters in portions of the site and saturation of soils to the surface were observed in the wetland just prior to the growing season (late March 2003, see Figure 5.2). Similar conditions were present in the first week of the growing season (early April). Seepage was also observed during these visits in an area of exposed soils. During the next site visit, one month into the growing season, inundation or saturation within 12 inches was not observed. A wetland delineation is scheduled for the spring of 2004.

Figure 5.2 SR 706 Ashford Mitigation Site (March 2003)

Success Standard 6 – 75% or Greater Survival in the Buffer

A qualitative[17] assessment determined that woody plantings were generally established as planned in the buffer areas of the site. Areas of mortality were replanted in October 2003. Development of these areas is likely to be slow as long as ungulate browsing continues.

[17] Plant mortality, subsequent re-planting, and natural recruitment often confound results if survival is quantified long after initial plant establishment. For this reason, a qualitative estimate was made of viability.

Success Standard 7 – Establishment of Planted Species that Provide Wildlife Food
Plantings on site are generally well established, but growth and development have been slow due to browse pressure. Six of the established species provide a food source for birds and other wildlife. These include *Cornus sericea* (redosier dogwood), *Mahonia aquifolium* (tall Oregon grape), *Oemleria cerasiformis* (Indian plum), *Salix lucida* (Pacific willow), and *Salix sitchensis* (Sitka willow). Establishment of these species satisfies Success Standard 7.

Success Standard 8 – Mammals and Stable/Increasing Wetland-Dependent Bird Presence
Though ungulates have made plant establishment difficult, their presence suggests that large mammals are benefiting from use of the mitigation site. In addition, three wetland-dependent or wetland-associated bird species have been observed on site in most years. These species are the Common Yellowthroat (wetland-dependent), Wilson's Warbler (wetland-associated), and Willow Flycatcher (wetland-associated).[18] Although bird activity is relatively high along the riparian corridor to the west, survey results for the mitigation site do not indicate a statistically significant increase in species diversity or wetland-dependent bird presence over time. An increase in use of the site by more species may depend on the successful development of the buffer and scrub-shrub areas. Observations of mammals and a possibly stable wetland-dependent bird presence indicate that Success Standard 8 has been met.

Success Standard 9 – Amphibian Presence and Habitat
A Pacific Chorus Frog (*Pseudacris regilla*) egg cluster and Long-toed Salamanders (*Ambystoma macrodatylum*) were documented on site. However, the duration of inundation documented on site may not be sufficient to support successful breeding by amphibians. Habitat suitability assessments conducted on site also indicate the site presently provides marginal shelter and terrestrial foraging habitat for amphibians due to limited woody debris and leaf litter, and a lack of well-developed layers of vegetation.

Success Standard 10 – Site Development Per Plan
A comparison of site plans to current conditions reveals that the site was constructed according to plan. However, the site has not developed some of the intended characteristics. Browsing has interfered with development of the scrub-shrub and buffer communities and the period of inundation appears to be shorter than planned in some years. As a result, some intended functions, such as wildlife habitat for some species, may not presently be supported. This may change over time should structural diversity become more complex as the scrub-shrub and forested classes develop. Continued hydrology monitoring and a wetland delineation are scheduled for early spring 2004.

[18] Birds are assigned a wetland-dependent or wetland-associated species status based on the classification scheme presented and Brown and Smith (1998). Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

Management Activities

Manual and chemical control of weed species was implemented twice over the course of the 2003 growing season. Areas around woody conifer plantings were cleared to reduce competition and soil amendments were added in the wetland. Replanting of woody species in the buffer and wetland was implemented in October 2003.

Appendices

Appendix A

SR 101 Sequim Success Standards and Monitoring Tasks

The following excerpt is from the *State Route 101 Sequim Bypass Corridor Environmental Mitigation Plan* (Ward and Schlatter 1997). The standards and tasks addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals, Objectives & Standards

The following functions have been identified as important for the Sequim mitigation site.

1. Wildlife Habitat
2. Fisheries Habitat
3. Water Quality Improvement
4. Base flow support for Bell Creek

Of these four functions, it was decided that while #4 was very important, it was difficult to quantify as a performance standard, thus it was not included as a goal or performance standard in the mitigation plan.

The following are included as goals, objectives and performance standards.

Goals

To restore, preserve, and enhance wetlands on 23.25 ha (57.43 acres) site. An existing approximately 6.88 ha (17 acres) forested wetland will be preserved. Approximately 13.36 ha (33 acres) of wetland and wildlife habitat will be restored and enhanced. 3.24 ha (8 acres) will be a site buffer and riparian corridor. Emergent and open water habitats will be added to complement the existing shrub and forested wetland habitats to increase wildlife habitat diversity and enhance anadromous fish habitat. The site will be protected by a vegetated buffer along the southern end of the site and will be fenced to exclude cattle, improving the water quality in the wetlands.

Objective A

Restore 13.36 ha (33 acres) of the site to wetland conditions.

Standard A-1

A minimum of 10.12 ha (25 acres) will be restored to wetland conditions as determined by a wetland delineation completed in Year 5.

Methods:

The wetland shall be reestablished by installing ditch plugs and excavating shallow level spreader ditches to restore the wetland hydrology to the site.

Monitoring:
The delineation shall confirm the presence of hydrology. **Hydrology will be monitored during the monitoring period.**

Objective B

Increase wildlife habitat types and diversity by providing habitat for amphibians, increase structural diversity for birds, and by installing habitat structures.

Standard B-1

By Year 5 the site will provide suitable breeding habitat for frogs and salamanders. Species presence will be documented by live capture of adults or larvae, or observation of adults, larvae or egg masses.

Methods:
Excavate shallow ponds and plant a diversity of emergent species, providing a variety of stem diameters and water depths for egg deposition. Install plugs in ditches to allow for the creation of additional breeding areas.

Monitoring:
Use the appropriate technique depending upon the time of year. Egg mass surveys can be completed during the breeding season, or larvae can be trapped or dip-netted during the larval rearing season, or adults can be observed year-round or during the breeding season.

Standard B-2

Achieve a minimum of 70 percent survival of tree and shrub plantings by the end of Monitoring Year 1 on the site in both the wetland and buffer area.

Methods:
Create shrub and forested habitat areas within the existing pasture by planting groups of trees and shrubs. Establish a buffer along the southern portion of the site.

Monitoring:
Count number of dead and live tree and shrub seedlings.

Standard B-3

Install by the end of Monitoring Year 1 a minimum of 5 snags as perch trees, a minimum of 5 large woody debris piles and at least 10 bat boxes.

Methods:
Install according to plans.

Monitoring:
Document presence at completion of construction. **Locate structures on as-built plans. While no specific monitoring of use is required, visual inspection of each bat box for guano and inspection of the ground under each perch tree**

for whitewash and pellets during the site inspections should be done opportunistically.

Objective C

Create and enhance fish habitat in Bell Creek.

Standard C-1

By the end of Monitoring Year 1, 75% of relocated Bell Creek will be a pool and riffle complex.

Methods:

Relocate Bell Creek according to the plans.

Monitoring:

Complete the following measurements on Bell Creek, total relocated length, length of each pool, and length of each riffle.

Standard C-2

Install a minimum of 20 instream structures to provide cover for fish by Monitoring Year 1.

Methods:

Installation of structures will occur according to plan.

Monitoring:

Count number of installed structures in Monitoring Year 1.

Standard C-3

Provide a riparian corridor along Bell Creek which provides some shade along a minimum of 40 percent of the stream corridor after 10 years.

Methods:

Plant a riparian community along the banks of relocated Bell Creek.

Monitoring:

Measure the total length of the relocated creek, and measure length of all riparian areas supporting vegetation over three feet tall to determine percent of stream corridor which is shaded.

Objective D

Reduce the opportunity of the water in the on-site portion of Bell creek and in the on-site portion of the wetland to become polluted with nitrates from cow manure.

Standard D-1

Exclude cattle from the mitigation site.

Methods:

Fence site with a cattle proof fence where there are active pastures adjacent.

Monitoring:
Visually inspect the site for cattle or signs of cattle intrusion.

8.0 MONITORING PLAN

This site will have a 10-year monitoring schedule for the riparian and forested areas and a five-year schedule for the emergent and scrub-shrub areas. Each schedule will have 3 intensive monitoring cycles. The areas to be monitored for five years will have intensive cycles at years 1, 3, and 5. The areas to be monitored for ten years will have intensive cycles at years 1, 5, and 10, with informal monitoring cycles at years 3 and 7.

Monitoring will be tied to the specific Objectives and will include:

1. As built plan preparation – a survey of the mitigation site will be done that includes (but is not limited to) topography, habitat structures/features, planting areas, and fences. Directly supports Objectives B, C, and D

2. Vegetation survey utilizing a combination of line transect, line intercept, and large diameter sampling plots depending upon the specific objectives and standards set. Sampling will directly support Objectives A, B, and C.

3. **Breeding bird surveys – sampling stations will be located in each desired vegetation/habitat zone (e.g. forested, emergent, riparian, etc.). Survey will be a simple presence of species census. Surveys will support Objective B.**

4. **Amphibian egg mass surveys – appropriate methodology and protocol is currently being developed by WSDOT monitoring staff. Surveys will directly support Objective B.**

5. **Aquatic macroinvertebrate sampling – invertebrates will be identified to Order for all individuals, and to family in the orders Ephemeroptera, Plecoptera, and Tricoptera. Surveys will be conducted to indirectly support Objective C.**

6. **Water quality testing. Sampling will support Objective D.**

7. Groundwater monitoring – a minimum of 5 automatic recording groundwater monitoring wells will be installed during construction of the site. Information gathered by the wells will be incorporated into the monitoring reports. Monitoring directly supports Objective A.

8. Photographic record – a photographic record will be made at permanent stations over the course of the monitoring schedule to provide a lasting, visual record of the site's progress. Supports overall permit compliance.

Appendix B

SR 7 Nisqually Slough Success Standards

The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.[19]

- 100% Survival (or replacement) of trees and shrubs at the end of year one. Non-invasive volunteer species are acceptable to include in this total.

- 70% cover of grasses and forbs within the wetland creation and upland buffer areas by the end of year three.

- Tree and shrub canopy aerial canopy cover within the wetland creation area will meet or exceed 60 % by the end of year five. Non-invasive volunteer species are acceptable to include in this assessment.

- Tree and shrub canopy cover within the planted upland buffer area will meet or exceed 30% by the end of year five. Non-invasive volunteer species are acceptable to include in this assessment.

- **Hydrology (within 12 inches of the soil surface) within the wetland creation area must be present for at least 12.5% of the growing season (consecutively). Although reasonable assumptions based on site observations (vegetation, soil, hydrology indicators) can be made each year during the early part of the growing season so that direct observations of hydrology can be made.**

- **Cover of reed canarygrass, or other invasive species may not exceed 20 percent of the total wetland or buffer area at any time during years one through five.**

Excerpted from the *SR 7 MP 40 to MP42.4 Wetland Mitigation Plan* (Russell 1999). Standards of success and contingency plans addressed this year are identified in **bold** font. Old success standards are lined out and replaced by standards listed above.

GENERAL GOALS

The general goal of the wetland mitigation plan is to create 3,300 square meters (35,522.10 square feet) of forested wetland, as well as enhance adjacent upland buffer area, which will provide wildlife habitat, groundwater recharge, and water quality

[19] NEW GOALS AND PERFORMANCE STANDARDS: Revised per letter from Carl Ward to Dave Risvold: Pierce County Department of Planning and Land Services dated 1-8-03. See below for old success standards (~~lined out~~) and rest of the mitigation plan.

functions. The following summarizes the goals that must be met by the third growing season after monitoring:

- Create a recognizable plant community that will develop into a forested wetland, and upland buffer community.

- Create a seasonally saturated wetland hydrologic regime that meets the criteria of the 1997 Washington State Manual (ECY, 1997), i.e., at least 12.5% of the growing season.

- Create a hydrologic connection between Wetland A (the slough of the Nisqually River) and the created wetland area.

The following summarizes the performance standards that the wetland creation and enhancement areas must meet:

- 100 percent survival (or replacement) of trees and shrub species at the end of year one. Non-invasive volunteer species are acceptable in all zones and may be used in estimating percent cover of ~~emergent species~~ and credited toward survival of planted trees and shrubs.

- ~~Vegetative success must equal or exceed 80 percent survival of planted trees and shrubs, and 80 percent cover of emergent species by the end of year five, or additional planting (and monitoring) to achieve such.~~

- **~~Hydrology (within 12 inches of the soil surface) within the wetland creation area must be present for at least 12.5% of the growing season (consecutive).~~**

- **~~Cover of reed canarygrass, or other invasive species may not exceed 20 percent of the total wetland area at any time during years one through five.~~**

The following summarized the performance standards that the upland buffer enhancement areas must meet:

- 100% survival (or replacement) of trees and shrubs at the end of year one. Non-invasive volunteer species are acceptable in all zones and may be used in estimating toward survival of planted trees and shrubs**.**

~~Using the Canopy Coverage Method during years 1-2, and the Line Intercept Method during years 4-5, the following standards of success for vegetative growth in all areas (as applicable) shall be met as shown in Table 3:~~

~~Table 3. Vegetative standards of success by year and layer for wetland creation and enhancement, and upland enhancement areas (as applicable).~~

	~~Tree~~	~~Shrub~~
~~Year #1~~	~~20%~~	~~30%~~
~~Year #2~~	~~20%~~	~~40%~~
~~Year #4~~	~~40%~~	~~50%~~
~~Year #5~~	~~40%~~	~~60%~~

CONTIGENCY PLAN

In the event that the goals and objectives are not met by the third year, contingency measures must be taken. These include but are not limited to replanting dead plants, hydrologic manipulation, irrigation, mulching of plants, weed control, trash removal, erosion repair, and any other practices necessary to meet the goals of the mitigation plan. Recommendations to correct deficiencies will be made after each site visit by the wetland biologist. WSDOT will correct deficiencies in a timely and responsible manner.

Appendix C

SR 161 Kapowsin Success Standards

The following excerpt is from the *MP 13 to MP 14 Safety Improvements (Junction Kapowsin Highway Vicinity)* (Russell, 1998). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

GOALS AND PERFORMANCE STANDARDS

The general goal of the wetland mitigation plan is to create or enhance approximately .12 hectares (.32 acres) of forested wetland, as well as enhance .12 hectares (.32 acres) of upland buffer area, which will provide wildlife habitat, groundwater recharge, and water quality functions. The following summarized the goals that must be met by the third growing season after monitoring:

- Create a recognizable plant community that will develop into a forested wetland, and upland buffer community.

- Create a seasonally saturated wetland hydrologic regime that meets the criteria of the 1997 Washington State Manual (ECY, 1997), i.e. at least 12.5% of the growing season.

- Maintain, but not expand, a hydrologic connection between Muck Creek and the created and enhanced wetland areas.

The following summarizes the performance standards that the wetland creation and enhancement areas must meet:

- 100% survival (or replacement) of trees, shrubs, and emergent species at the end of year one. Non-invasive volunteer species are acceptable in all zones and may be used in estimating percent cover of emergent species and credited toward survival of planted trees and shrubs.

- Vegetative success must equal or exceed 80 percent survival of planted trees and shrubs, and 80 percent cover of emergent species by the end of year five, or additional planting (and monitoring) to achieve such.

- **Hydrology (within 12 inches of the soil surface) within the wetland creation area must be present for at least 12.5% of the growing season (consecutive).**

- **Cover of reed canarygrass, or other invasive species may not exceed 20 percent of the total wetland area at any time during years one through five.**

The following summarizes the performance standards that the upland buffer enhancement areas must meet:

- 100% survival (or replacement) of trees and shrubs at the end of year one. Non-invasive volunteer species are acceptable in all zones and may be used in estimating toward survival of planted tress and shrubs.

- Vegetative cover (grass herbaceous material) in upland buffer areas is a minimum of 90 percent after year five.

Using the Canopy Coverage Method during years 1-2, and the Line Intercept Method during years 4-5, the following standards of success for vegetative growth in all areas (as applicable) shall be met as shown in Table 3:

Table 3. Vegetative standards of success by year and layer for wetland creation and enhancement, and upland enhancement areas (as applicable).

	Tree	**Shrub**	**Emergent**
Year #1	20%	30%	30%
Year #2	**20%**	**40%**	**50%**
Year #4	40%	50%	70%
Year #5	40%	60%	80%

MAINTENANCE AND MONITORING PLAN

The following list features of the wetland creation project which will or may require on-going maintenance. Although it strives to include all potential maintenance needs, unforeseen problems are likely to arise. Therefore, it is essential that WSDOT personnel the site at least 2 times a year during the first two growing seasons following construction to assure that maintenance or corrections are promptly made. In addition to the 4 visits during years 1 and 2, monitoring will also occur in years 4 and 5.

- Loss of tree or shrub species (wetland and buffer species) for various reasons-replace or replant as needed.

- Presence of reed canarygrass, or other invasive species – hand pull monthly May-August, wick with approved herbicide as needed in late June/early July.

- Poor growth of upland buffer plants – apply slow release balanced fertilizer.

Monitoring will occur regularly to measure the success of the wetland creation project and determine if the goals have been met. The following monitoring documentation will occur:

Vegetative Survival – Plant survival, species composition and vigor status will be measured in sample plots. The location of the vegetation sampling plots will be shown

on the as-built planting plan. Survival of vegetation will be assessed after the first growing season, and at least once (July 1 to mid-August) in years 2, 4, and 5.

Hydrology – Hydrology will be measured by the placement of remote electronic wells to measure water depth. Hydrology will be measured once a day for at least the first year, and likely during the second year as well. If data during the first two years shows that the hydrology criteria is being met, then hydrology will be measured only once during years 4 and 5.

Wildlife – Three formal bird surveys will be conducted each monitoring season from permanent census stations throughout the mitigation site. Surveys will take place between sunrise and noon, from May through June. Biologists will conduct the survey by standing silently at a station for five minutes, followed by five minutes of recording all bird species detected by sight or sound within 30 meters of the mitigation site. In addition to the surveys, any wildlife sign (e.g. tracks, scat), and/or other sightings will be recorded during all site visits. The bird surveys will be conducted during optimal weather conditions, i.e. little or no precipitation, and light to no wind, to ensure good visibility.

Photo stations – A total of five photo stations will be located throughout the area. Each photo station will consist of a permanent marker where photographs will be taken at each compass point (N, S, E, and W) once a year in years 1, 2, 4, and 5 at the height of the growing season (July 15 to August 1).

At completion of construction an as-built plan will be prepared showing any deviations from the wetland creation plan. This can also serve as the baseline monitoring report. Monitoring reports will be prepared on a yearly basis for each monitoring year, and submitted to the appropriate regulatory agencies.

Additional monitoring to assess and address maintenance issues will be performed from May through August for the first two years. These visits will include checking for the presence of invasive plants, damage due to vandalism, drought and any other unforeseen problems. These visits are necessary so that prompt control measures can be taken.

CONTINGENCY PLAN

In the event that the goals and objectives are not met by the third year, contingency measures must be taken. These include but are not limited to replanting dead plants, hydrologic manipulation, irrigation, mulching of plants, weed control, trash removal, erosion repair, and any other practices necessary to meet the goals of the mitigation plan. Recommendations to correct deficiencies will be made after each site visit by the wetland biologist. WSDOT will correct deficiencies in a timely and responsible manner.

Appendix D

SR 706 Ashford Success Standards

The following excerpt is from the *Wetland Mitigation Plan Supplement for Pierce County Wetland Management Regulations SR 706, 305th Ave East to Anderson/Kernahan Roads* prepared by WSDOT Olympic Region, December, 1995. Performance Standards addressed this final year are identified in **bold** font.

Goals

The goals of this wetland compensation site are: (1) to create 0.6 acre of the physical environment necessary to support and promote the development of wetland characteristics; and (2) to compensate for the wetland functions and values that will be lost due to filling 0.315 acre of wetland during construction of the roadway improvements.

Objectives and Performance Standards

Hydrology

Objective 1. Establish wetland hydrology on 0.6 acre of existing pasture through excavation and recontouring the existing ground.

Performance Standard: **Soil saturation at or near the surface in most years as indicated by the development of hydric soil characteristics.**

Objective 2. The site is located adjacent to the roadway, but it will not receive any runoff from the road. Because of the plan to utilize water from upgradient fields and swales that are currently used as pasture, the dense stands of vegetation that will be established will help facilitate the treatment of water within the wetlands. The vegetation will help attenuate flows and allow for increased groundwater recharge. The wetland will also provide sediment trapping capability and nutrient retention and transformation from the upgradient sources.

Performance Standard 1: **An increase in potential stormwater storage will be confirmed by as-built surveys of the creation site following construction.**

Performance Standard 2: **Establishment of dense stands of vegetation and flat grades to facilitate flow attenuation, nutrient and sediment retention, and capability for groundwater recharge. Will meet standard if grade is per plan and Vegetation Performance Standards (see following Section) are met.**

Vegetation

Objective 1. The wetland areas created in the compensation site will develop as emergent/scrub-shrub and eventually forested areas over time.

Performance Standard 1: After one year wetland will have 95% survival of planted tree and shrub species. Recruitment of native species is expected and should increase the overall areal coverage of wetland plants.

Performance Standard 2: After three years wetland will have 75% survival of planted species. Facultative or wetter species (planted and/naturally colonizing) will have 75% or greater aerial cover. Conformance will measured through surveys at permanent monitoring plots.

Performance Standard 3: **After five years the wetland portion of the site will have about 35-50% palustrine scrub-shrub and 50-65% palustrine emergent wetland area as measured by aerial coverage. Scrub-shrub is considered all woody species <3 inches dbh.** Conformance will be measured through surveys at permanent monitoring plots.

Performance Standard 4: **After five years approximately 90% of the species present should be native species.** Conformance will measured through surveys at permanent monitoring plots.

Objective 2. An area of 1.42 acres will be preserved and enhanced as upland buffer between the wetland creation and preservation areas and adjacent land uses.

Performance Standard 1: **Buffer planted per plan with greater than 75% survival of planted species over 5 years.**

Habitat

Objective 1. This wetland area should provide some habitat for wildlife species, principally birds and small mammals. Because of the location in a rural setting, the site will be suitable for large mammals usage. There was noted high elk use of surrounding habitat areas, so it is expected that the wetland, as it develops, will also be suitable elk habitat. Because of the small size of the site, it is not expected to fulfill the complete habitat needs for any individual species. The site is expected to by use primarily as foraging habitat.

Performance Standard 1: **Establishment and growth of the species planted that were in part selected to provide a food resource for wildlife species.**

Performance Standard 2: **The presence of wildlife species utilizing the site will be noted during the monitoring visits. Recording of mammals will be through incidental observation of individuals or signs. Stable or increasing presence of wetland dependent bird species during the bird surveys will indicate utilization by the target species.**

Objective 2. The wetland will be suitable for some species of amphibians. Because the mitigation site is not connected to a creek, it will not be of value to downstream fisheries.

Performance Standard 1. **Development of amphibian habitat, principally terrestrial foraging habitat. Some breeding habitat may be established for species that do not exclusively use deep open water areas such as the Pacific treefrog. Positive indicator of success include on-site verification of presence, and successful establishment of wetland habitat.**

Human Value Functions

Objective 1. Create a wetland that is congruous with the landscape and in harmony with the overall viewshed as the site will be visible from the highway which is the corridor leading the Mt. Rainer National Park

Performance Standard: Site development per plan.

4.2.7 Weed Control

Weed control measures for the SR 706 project will entail the eradication of undesirable vegetation prior to planting or soil amendment incorporation. The method of application, type of herbicide used, and timing of application will depend on site specific situations. All applications will be performed by a licensed applicator and be done in compliance with the label and WA State Department of Agriculture rules and regulations.

After the sites have been planted, the use of herbicide will be limited to eradication of unwanted or exotic vegetation. As the plant material becomes established the use of herbicides will be restricted to controlling noxious weeds and other exotic species.

It is WSDOT's policy to utilize an Integrated Pest Management (IPM) approach to weed control. The use of herbicide will be limited to the extent absolutely required. In many situations, hand pulling of individual weeds or other types of mechanical means will be adequate to control the unwanted vegetation. The goal of this department is to control

only the amount of herbaceous material necessary to allow the plantings to become established and compete on their own and to keep exotics species from invading the sites.

Appendix E

Nativity of Plants Observed at the SR 706 Ashford Mitigation Site in 2003

Scientific Name	Common Name
Native	
Acer circinatum	vine maple
Achillea millefolium	common yarrow
Alnus rubra	red alder
Carex microptera	appressed sedge
Carex stipata	sawbeak sedge
Cornus sericea	redosier dogwood
Deschampsia caespitosa	tufted hairgrass
Juncus effusus	soft rush
Mahonia aquifolium	tall Oregon grape
Oemelaria cerasiformis	Indian plum
Populus balsamifera	black cottonwood
Pteridium aquilinum	wetsern brackenfern
Rubus ursinus	California blackberry
Salix lucida	Pacific willow
Salix scouleriana	Scouler's willow
Salix sitchensis	Sitka willow
Solidago canadensis	Canada goldenrod
Urtica dioica	stinging nettle
Non-Native	
Agrostis capillaris	colonial bentgrass
Agrostis gigantea	redtop
Anthoxanthum odoratum	sweet vernalgrass
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Coronilla varia	crown vetch
Crepis capillaris	smooth hawksbeard
Cytisis scoparius	Scot's broom
Dactylis glomerata	orchard grass
Eymus repens	quackgrass
Festuca rubra	red fescue
Holcus lanatus	common velvetgrass
Hypericum perforatum	common St. Johnswort
Hypochaeris radicata	hairy catsear
Lathyrus sylvestris	flat pea
Leucanthemum vulgare	oxeye daisy
Lolium arundinaceum	tall fecue
Lolium pratense	meadow ryegrass
Phalaris arundinacea	reed canarygrass
Phleum pratense	Timothy
Plantago lanceolata	narrowleaf plantain

Poa pratensis	Kentucky bluegrass
Ranunculus repens	creeping buttercup
Rubus armeniacus	Himalayan blackberry
Rumex acetosella	common sheep sorrel
Rumex crispus	curly dock
Taraxacum officinale	common dandelion
Trifolium hybridum	alsike clover
Trifolium repens	white clover

Glossary of Terms

Abundance (total) – the total number of individuals, cover, frequency of occurrence, volume, or biomass of a species, or group of species, within a given area.

Accuracy – the closeness of a measured or computed value to its true value.

Adaptive management – the process of linking ecological management within a learning framework (Elzinga et al. 1998).

Aerial cover – is the percent of ground surface covered by vegetation of a particular species (or suite of species) when viewed from above (Elzinga et al. 1998). Values for aerial cover are typically obtained from point-line, point-frame, or line-intercept data.

Areal estimates – are made using the known boundary of a feature or statistical population. Areal estimates are often expressed in units of area.

Aquatic vegetation – includes submerged and rooted (*Elodea*, *Myriophyllum*) or floating (non-rooted) plants (*Lemna, Azolla, Wolfia*). For compliance purposes, these plants are not included in cover estimates. Vascular, rooted, floating-leaved plants *are* included in cover estimates (e.g., *Nuphar, Potamogeton*).

Bare ground – an area that can support, but does not presently support vascular vegetation.

Canopy cover – the coverage of foliage canopy (herbaceous or woody species) per unit ground area.

Community – a group of populations of species living together in a given place and time.

Confidence interval (CI) – is an estimate of precision around a sample mean. A confidence interval includes confidence level and confidence interval half-width.

Cryptogam – any of the *Cryptogamia*, an old primary division of plants comprising those without true flowers and seeds including ferns, mosses, and thallophytes (algae, fungi, and lichen).

Density – the number of plants per unit area (typically square meters).

Densitometer – a hollow T-shaped polyvinyl chloride (PVC) device that includes horizontal and vertical leveling and a mirror to locate a precise vertical point in space either directly above or directly below the densitometer. Target vegetation intersecting the vertical line of sight through the instrument is recorded.

Herbaceous – with characteristics of an herb; an annual, biennial, or perennial plant that is leaflike in color or texture, and not woody.

Hydric soils – soils formed under the conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register 1994).

Invasive – a plant that interferes with management objectives on a specific site at a specific point in time (Whitson et al. 2001). For monitoring purposes, invasive species include those listed on the current County Noxious Weed List, and on a site-by-site basis, other species may be included (such as *Rubus armeniacus* (Himalayan blackberry)).

Line-segment –a linear sample unit that is used to measure vegetative cover.

Macroplot – usually refers to a relatively large sampling area in which sub-sampling will be conducted, often using quadrats, line-segments or point-lines (Elzinga et al. 1998).

Open water – an area intended to be non-vegetated and permanently inundated as described in the site mitigation or planting plan.

Point-frame – is a square or rectangular quadrat that consists of a set of identified points used to collect vegetation data.

Point-intercept device – a tripod that supports a rod that can be leveled and lowered vertically to intercept target vegetation at an identified point.

Point-line – linear series of points comprising a sample unit.

Point-quadrat (points) – a single point, used to sample vegetation data. The point quadrat is theoretically dimensionless.

Population (biological) – all individuals of one or more species within a specific area at a particular time.

Population (statistical) – the complete set of individual objects (sampling units) about which inferences are made.

Precision – the closeness of repeated measurements of the same value.

Quadrat – an area delimited for sampling flora or fauna; the sampling frame itself.

Random sampling – sampling units drawn randomly from the population of interest.

Relative abundance (birds) – the number of individuals per unit of sampling effort.

Relative cover – the relative cover of a plant species (or suite of species) is the proportion of the target species coverage compared to that of all species in the plant community combined (Brower et al. 1998).

Restricted random sampling method – a sampling method that divides the population of interest into equal-sized segments. In each segment, a single sampling unit is

randomly positioned. Sampling units are then analyzed as if they were part of a simple random sample (Elzinga et al. 1998).

Sample – a subset of the total possible number of sampling units in a statistical population.

Sample size equations – use sample mean and standard deviation to determine if data have been collected from enough sample units to meet the sampling objectives.

Sample standard deviation – a value indicating how similar each individual observation is to the sample mean.

Sampling – the act or process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.

Sampling objective – a clearly articulated goal for the measurement of an ecological condition or change value (Elzinga et al. 1998). Sampling objectives provide a complement to success standards and describe the desired level of precision for sampling. Elements of a sampling objective include the desired confidence level and confidence interval half-width, or the acceptable false-change error and acceptable missed-change error level.

Sampling units – the individual objects that collectively make up a statistical population.

Standard deviation – a measure of how similar each individual observation is to the overall mean value.

Shrub – a woody plant which at maturity is usually less than six meters (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

Species richness – the total number of species observed on a site.

Structures – any structure that is not expected to support vegetation during the monitoring period. Structures may include habitat structures, rocks, and other artifacts.

Stratified random sampling method – the population of interest is divided into two or more groups (strata) prior to sampling. Within each stratum the sample units are the same. Sample units from different strata may or may not be identical. Random samples are obtained within each group (Elzinga et al. 1998).

Systematic random sampling method – the regular placement of quadrats, points, or lines along a sampling transect following a random start.

Transect – For vegetation surveys, the transect is a line used to assist in the location sample units (point-lines, quadrats, line-segments or frames) across the monitoring study area.

Tree – a woody plant that at maturity is usually six meters (20 feet) or more in height and generally has a single trunk, unbranched for one meter or more above ground, and more or less definite crown (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

Vegetation structure – the physical or structural description of the plant community (e.g. the relative biomass in canopy layers), generally independent of particular species composition.

Wetland-dependent species (birds) – restricted in temporal or spatial distribution to wetlands based on an intrinsic feature or features of the environment (Finch 1989).

Literature Cited

1. Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

2. Brower, J. E., J. H. Zar and C. N. von Ende. 1998. Field and Laboratory Methods for General Ecology. WCB McGraw Hill, Boston, MA; p.88.

3. Brown, S. C. and C. R. Smith. 1998. Breeding Season Bird Use of Recently Restored Versus Natural Wetlands in New York. Journal of Wildlife Management. 62(4):1480-1491.

4. Cooke, S. S., (ed.). 1997. A Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon. Seattle Audubon Society, Seattle, WA.

5. Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of The United States. United States Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

6. Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The Birder's Handbook. Simon and Schuster, Inc., NY.

7. Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730. National Business Center, Denver, CO.

8. Executive Order 89-10. WSR 90-01-050. Protection of Wetlands. December 11, 1989.

9. Federal Register. July 13, 1994. Changes in Hydric Soils of the United States. Washington, D.C. (current Hydric Soil Definition).

10. Finch, D. M. 1989. Habitat Use and Habitat Overlap of Riparian Birds in Three Elevational Zones. Ecology 70 (4): 866-880.

11. Hruby, T., T. Granger, and E. Teachout. 1999. Methods for Assessing Wetland Functions. Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington. Part 2: Procedures for Collecting Data. Washington State Department of Ecology Publication #99-116, Olympia, WA.

12. Kent, M. and P. Coker. 1995. Vegetation Description and Analysis: A Practical Approach. John Wiley and Sons. West Sussex, England.

13. Krebs, C. J. 1999. Ecological Methodology, 2nd edition. Benjamin/Cummings, New York, NY.

14. Kupper, L. L. and K. B. Hafner. 1989. How Appropriate are Popular Sample Size Formulas? The American Statistician (43): 101-105.

15. Olson, D. H., Leonard, W. P., and R. B. Bury. 1997. Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific Northwest. Society for Northwestern Vertebrate Biology. Olympia, WA.

16. Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. Gen. Tech. Rep. PSW-GTR-144. Pacific Southwest Research Station, Forest Service, Department of Agriculture, Albany, CA.

17. Reed, P. B. 1988. National List of Plant Species that Occur in Wetlands: Northwest (Region 9). United States Department of the Interior. Fish and Wildlife Service. Biological Report 88 (26.9).

18. Reed, P. B. 1993. Supplement to the National List of Plant Species that Occur in Wetlands: Northwest (Region 9). United States Department of the Interior. Fish and Wildlife Service. Supplement to Biological Report 88 (26.9).

19. Russell. 1999. SR 7 MP 40 to MP 42.5 Wetland Mitigation Plan. Washington State Department of Transportation, Olympic Region, Environmental/ Hydraulic Services Office, Olympia, WA.

20. Russell, Eric. 1998. MP 13 to MP 14 Safety Improvements (Junction Kapowsin Highway Vicinity). Washington State Department of Transportation, Environmental/Hydraulic Services Office, Olympic Region, Olympia, WA.

21. Shabman, L. A. 1995. Making Watershed Restoration Happen: What Does Economics Offer? In Rehabilitating Damaged Ecosystems, J. Cairns (ed.), pp. 35-47. Lewis Publishers, Boca Raton, FL.

22. Smith, M. R., P. W. Mattocks, Jr., and K. M. Cassidy. 1997. Breeding Birds of Washington State. Volume 4 in Washington State Gap Analysis – Final Report (K. M. Cassidy, C. E. Grue, M. R. Smith, and K. M. Dvornich (eds.)). Seattle Audubon Society Publications in Zoology No. 1, Seattle, WA.

23. Thom, R. M. and K. F. Wellman. 1996. Planning Ecosystem Restoration Monitoring Programs. Evaluation of Environmental Investments Research Program, United States Army Corps of Engineers, IWR Report 96-R-23.

24. Thomas, J. W. (tech. ed.). 1979. Wildlife Habits in Managed Forests – the Blue Mountains of Oregon and Washington. United States Department of Agriculture Forest Service, Agricultural Handbook No. 553.

25. United States Army Corps of Engineers. 1993. Department of the Army Nationwide Permit 93-4-00282.

26. United States Army Corps of Engineers. 1996. Department of the Army Individual Permit 96-4-00923.

27. United States Department of Agriculture, Natural Resources Conservation Service. 2003. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

28. Ward and Schlatter. 1997. State Route 101 Sequim Bypass Corridor Environmental Mitigation Plan. Olympic Region Environmental and Hydraulic Services Office, Olympia, WA.

29. Washington State Department of Ecology. 1997. Washington State Wetlands Identification and Delineation Manual. Ecology Publication No. 96-94. Olympia, WA.

30. Washington State Department of Transportation. 1995. Wetland Mitigation Plan Supplement for Pierce County Wetland Management Regulations SR 706, 305th Ave East to Anderson/Kernahan Roads. Olympic Region Environmental Section, Olympia, WA.

31. Washington State Noxious Weed Control Board. 2003. Washington State Noxious Weed List. www.nwcb.wa.gov. WA.

32. Whitson, T. D. (ed.). 2001. Weeds of the West. The Western Society of Weed Science. 9th edition. Grand Teton Lithography, Jackson WY.

33. Williams, M. S. 2001. New Approach to Areal Sampling in Ecological Surveys. Forest Ecology and Management 154:11-22.

34. Zar, J. H. 1999. Biostatistical Analysis, 4th edition. Prentice-Hall, Inc., Upper Saddle River, NJ.